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PENSOFT

First records of *Agamyxis pectinifrons* (Cope, 1870) (Siluriformes, Doradidae) from the state of Chiapas, Mexico, and an extension of the geographic range in the Grijalva river basin

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Abstract

We provide the first records of occurrence of Spotted Raphael Catfish, *Agamyxis pectinifrons*, in Chiapas, Mexico, and extend the geographic range of this species in the Grijalva river basin. We collected 42 specimens, for which we present morphological and meristic data from 28 of these. The larger number of individuals and the range of sizes recorded suggest that *A. pectinifrons* is established in this region of the Grijalva basin.

Keywords

Invasive species, ornamental fish, Spotted Raphael Catfish, Usumacinta province

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Introduction

The introduction of invasive alien species (IAS) is a phenomenon that is currently threatening the biodiversity in Mexico. The invasions of alien species are known to result in increased competition (e.g., for feeding and breeding sites) with native creatures (Orfinger and Goodding 2018). Such species also often show high tolerance to stressful physical and chemical factors in the environment. Together with the absence of natural predators, such invasive species are often highly successful once they are established in new locations (Contreras-Macbeath et al. 1998). In aquatic systems, the presence of IAS such as loricariids may also affect water quality, as they dig large galleries to build their nests. This often results in increased suspension of sediments, which may in turn modify the composition of the algal communities and alter the ecosystem's food web (Power 1990).

The economic losses caused by the presence of IAS can be significant. For example, in the lower Balsas River

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region (Mexico), the presence of Armed Fish, *Pterygoplichthys disjunctivus* (C. Weber, 1991), has reduced the catch of tilapia, with annual losses estimated to be 36 million Mexican pesos (Mendoza et al. 2007). In addition, species of Doradidae and Loricariidae from South America have been detected worldwide as IAS in aquatic systems due to their high commercialization value as ornamental fish (Contreras-Macbeath et al. 1998).

Spotted Raphael Catfish, *Agamyxis pectinifrons* (Cope, 1870), belongs to the family Doradidae, and due to its physical appearance is one of the most often sold ornamental fishes (Arce et al. 2013). This catfish is naturally distributed in the Amazon basin (Nelson 2006), living in places with free-floating macrophytes and tropical forests that flood during the high-water season (Correa et al. 2008). This species is relatively small, reaching less than 150 mm long. Morphologically, *A. pectinifrons* resembles *A. albomaculata* (W.K.H. Peters, 1877), which is distributed in the Orinoco river basin (Arce et al. 2013). In Mexico, Álvarez-Pliego et al. (2021) reported the presence of *A. pectinifrons* for the first time in the La Sierra River, which is part of the Grijalva basin, Tabasco, Mexico. No other record of *A. pectinifrons* in southeastern Mexico has been published.

Methods

Our fieldwork was carried out in December 2021, during biological monitoring in the municipality of Juárez, Chiapas (Figs. 1, 2). To capture the specimens, we used two crab traps (60 cm long × 30 cm high, with a mesh size of 3 cm), with a sampling effort equal to 40.56 hours. The identification of each specimen was corroborated using the characteristics described by Birindelli and de Sousa (2018), and Álvarez-Pliego et al. (2021). All the specimens were photographed with a Canon EOS 80D and measured for 19 morphometric and meristic traits using a dial caliper (Neiko 01407A, China; Table 1). Tissue samples were taken from the caudal fin and placed in vials of 96% ethyl alcohol for preservatopm in 70% ethyl alcohol in the ichthyological collection of the Colegio de la Frontera Sur, San Cristobal de Las Casas, Chiapas, Mexico (ECOSC). For each morphometric and meristic trait, we included the minimum and maximum values and calculated the average and standard deviation. The collections of the specimens were made under the collection permit PPF/DGOPA-076/21. We produced the map (Fig. 1) using QGIS v. 3.18.1-Zürich (QGIS Development Team 2021) and included locality information provided by Álvarez-Pliego et al. (2021) along with our personal data set.

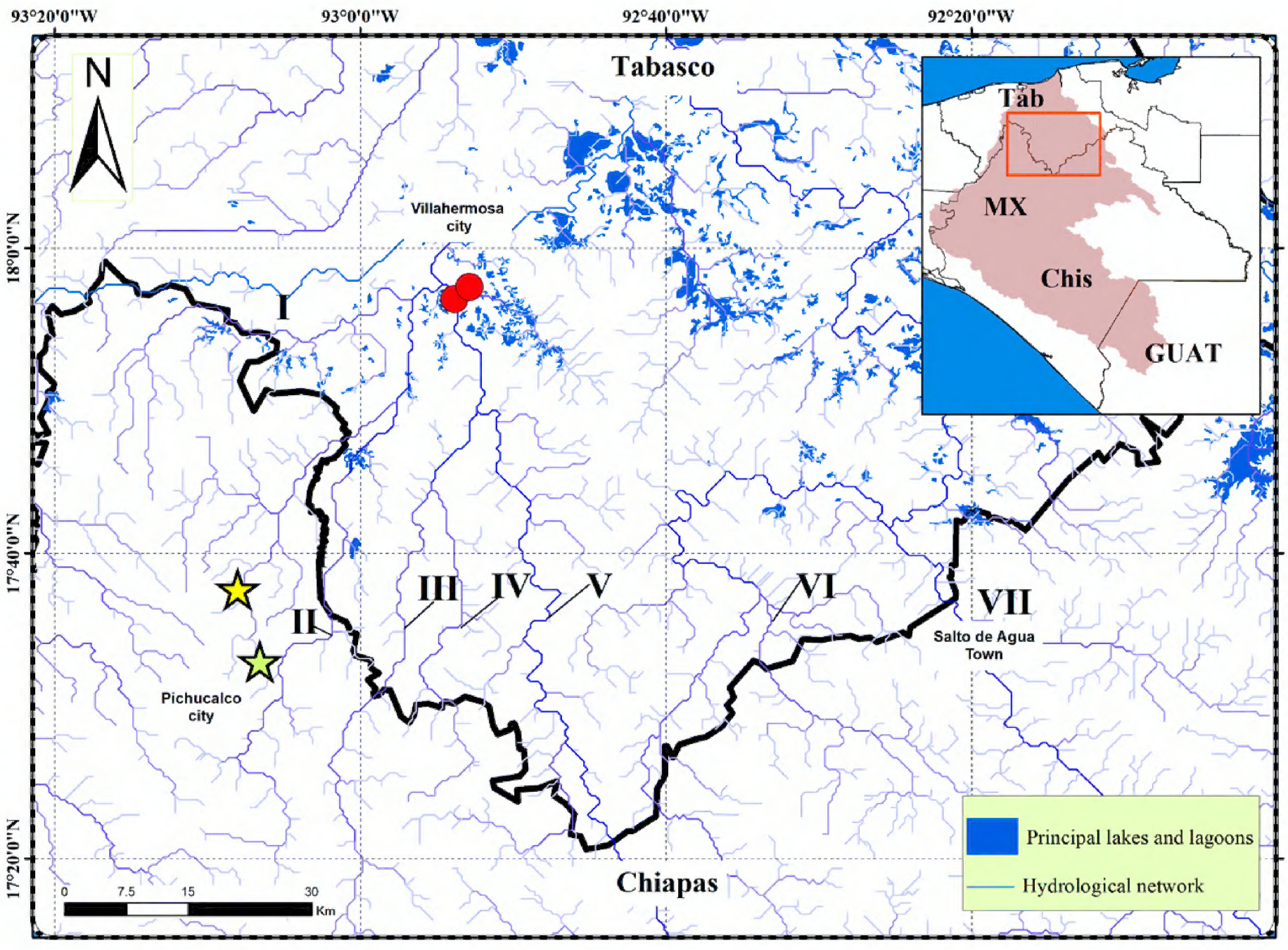

Figure 1. Records of *Agamyxis pectinifrons* in Chiapas (yellow star: locality in Juárez; green star: locality in Pichucalco) and Tabasco (red dots; Álvarez-Pliego et al. 2021). Countries are written in all capital letters, and states in capital and lowercase letters. GUAT = Guatemala, MX = Mexico, Chis = Chiapas, Tab = Tabasco, I = Mezcalapa, II = Pichucalco, III = Teapa, IV = Puyacatenango, V= Tacoltalpa-La Sierra, VI = Puxcatán, VII = Tulijá. Map prepared by Roni Fernando Gómez-Martínez.

Figure 2. Collection site of *Agamyxis pectinifrons* in the municipality of Juárez, Chiapas, Mexico. Photograph by Ernesto E. Perera-Trejo.

Results

***Agamyxis pectinifrons* (Cope, 1870)**
Figures 1–3

New record. MEXICO – **Chiapas** • Municipality of Juárez; 17.6275°, −093.1338°; 23 m a.s.l.; 11.XII.2021; E.E. Perera-Trejo & C.A. Guichard-Romero leg.; 42 juveniles (ECOSC14816).

Originally 48 individuals were collected, but due to damage caused by movement inside the traps, only 28 individuals were deposited in the ichthyological collection of ECOSUR. Specimens were collected in a private area with only a moderate rate of deforestation, where the vegetation had been converted mainly to pasture for cattle ranching. The individuals measured an average of 79.5 mm (± 3.9) in total length (Table 1). We examined 10 of the largest individuals, but none could be sexed.

Identification. The identification and differentiation of specimens from other taxa within the family Doradidae, were based on the presence of a row of mediolateral shields, each shield with a single posteriorly oriented spine, three pairs of short barbels, and a strong head shield (Birindelli et al. 2009). We considered the presence of one spine in each pelvic fin, and five ratios in each pectoral fin (Álvarez-Pliego et al. 2021) to differentiate our specimens from *A. albomaculata*.

Discussion

This is the first record of *A. pectinifrons* from the state of Chiapas, and only the second from the Grijalva river basin; Pliego et al. (2021) had previously recorded three individuals from the La Sierra and Chilapa rivers, Tabasco. Both localities are in the floodplain of the Grijalva river basin (Fig. 1). We extended the geographic distribution of this species approximately 45 km southwest of its previous location recorded in Tabasco by Álvarez-Pliego et al. (2021).

Prior to our record, in July 2021, a local person collected a specimen in the municipality of Pichucalco, 9.1 km south of the locality where we collected our individuals (Fig. 1; 17.5486°, −093.1098°; 29 m a.s.l.). Our high rate of capture of immature individuals, with minimal trapping effort, and the proximity of the Pichucalco River to La Sierra River, suggest that *A. pectinifrons* is proliferating throughout the middle portion of the Grijalva river basin. Additional study is needed to assess the impact of this species on native species. Similar

Figure 3. Left to right, ventral, dorsal and lateral view of *Agamyxis pectinifrons* from Chiapas. Scale bar = 1 cm. Photographs by Jesús Manuel López-Vila.

Table 1. Morphological and meristic data of *Agamyxis pectenifrons* captured in this study and by Álvarez-Pliego et al. (2021). Morphometric measurements are expressed in millimeters. Top: average (± standard deviation), bottom: minimum and maximum value.

	This study *n* = 28	**Álvarez-Pliego et al. 2021** *n* = 3
Total length	79.5 (3.9) 69–90	163 (13.8) 147–172
Standard length	66.7 (3.7) 58–54	136.3 (12.5) 122–145
Predorsal length	25.6 (3.9) 16–33	59.3 (7.5) 52–67
Preanal length	39.5 (3.2) 30–48	97.3 (7.2) 89–102
Head length	22.8 (2.7) 14–30	40.6 (0.5) 40–41
Interorbital distance	11.7 (1.7) 7–16	18 (1) 17–19
Mouth width	9.8 (1.5) 6–15	18.6 (0.5) 18–19
Maxillary barbel length	17.3 (3.5) 10–30	54 (4.3) 49–57
External mental barbel length	9.1 (2.7) 4–17	48.3 (3.5) 45–52
Internal mental barbel length	13.8 (2.9) 11–15	25.6 (4.7) 22–31
Body depth	26.2 (1.9) 20–29	48 (3.6) 44–51
Dorsal fin to adipose fin distance	22.9 (5.8) 12–39	31.3 (3) 28–34
Caudal-peduncle depth	11.6 (2.7) 10–13	13.3 (1.1) 12–14
Adipose fin to anal fin depth	16.6 (2.5), 14–17	24.6 (3.2) 21–27
Dorsal fin (spines)	2 (0)	2 (0)
Dorsal fin (rays)	5.1 (0.3), 5–6	5.3 (0.5) 5–6
Anal fin (spines)	2 (0)	2 (0)
Anal fin (rays)	7.2 (0.7) 6–8	8 (1) 7–9
Pelvic fin (spines)	1 (0)	1 (0)
Pelvic fin (rays)	5.1 (0.3) 5–6	6 (0)
Pectoral fin (spines)	1 (0)	1 (0)
Pectoral fin (rays)	5 (0)	5 (0)
Number of lateral bony plates	27 (0.1) 27–28	27.3 (0.5) 27–28

invasive species, such as *Pterygoplichthys* spp. (Wakida-Kusunoki and del Angel 2008; Sánchez et al. 2015), have had negative effects in the Grijalva–Usumacinta basin, mainly by affecting the structure of the native fish community. The increase in the abundance of *Pterygoplichthys* is negatively related to the abundance of native species (Escalera-Vázquez et al. 2019). Furthermore, changes in the water and habitat quality are related with the organic excretion of these fishes (Capps et al. 2011; Capps and Flecker 2013a, 2013b). Finally, the fishing activity in the region has been affected because *Pterygoplichthys* lowers the efficiency of the fishing gear used to capture commercial species (Mendoza-Carranza et al. 2018). A program to monitor, control, and remove *A. pectinifrons* may be important for the protection of the biodiversity of the Grijalva basin.

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Authors' Contributions

Conceptualization: ERG, EPT, CGR, AAGD. Formal analysis: ERG, AGD. Funding acquisition: ERG, CGR, AAGD. Investigation: ERG, EPT, CGR, AAGD. Writing – original draft: ERG, AAGD. Writing – review and editing: ERG, EPT, CGR, AAGD.

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